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Textures of sulfide-silicate-interactions in magmatic sulfide deposits

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The interaction of magmatic sulfide melt with silicate melt or silicate host rocks produces a large variation of textures. These include disseminated and net-textured sulfides, sulfide-matrix breccia ores and emulsions. Even though these textures are generated by different processes, it may be difficult to distinguish them from each other in hand specimen. As an example, net-textured sulfides form by sulfide melt infiltrating the host magmatic silicate cumulate, replacing interstitial silicate melt, whereas in sulfide matrix breccia ore, sulfide melt infiltrates older country rock along grain boundaries by partially melting the silicates. Both resulting textures will show silicate crystals with interstitial sulfides, indistinguishable in hand specimen. Therefore, this work aims to define clear distinction criteria between several sulfide-silicate-textures of magmatic sulfide ore deposits using petrographic and chemical analyses of samples from several magmatic ore deposits. Samples from the Nova-Bollinger deposit (Australia) are the main focus due to the large variety of different textures.

Silicate mineral assemblages of the sulfide-matrix breccia ore differ from those of the net-textures, depending on the composition of the infiltrated silicate rock. While silicate of the net-texture mostly consists of olivine, orthopyroxene, clinopyroxene and plagioclase, the sulfide-matrix breccia ore lacks olivine and contains quartz, garnet, cordierite and corundum. Furthermore, sulfide-matrix breccia ore shows a high percentage of symplectites (e.g. biotite-quartz, quartz-feldspar, corundum-sulfide) in contrast to the pyroxene-spinel-symplectites only found in the net-texture. Major and trace element analyses provide a clear distinction between emulsions, sulfide-matrix breccia ore, the metamorphic country rock, and the host magmatic rock. For example, pyroxene of the net-texture shows higher X_{Mg} (≈ 0.8) and Cr (up to 0.2 wt.%) content in comparison to metamorphic or emulsion-hosted pyroxene, which both have lower X_{Mg} (0.1 - 0.6) and Cr (0.05 wt.%). In addition, the emulsion-hosted pyroxene displays a significantly higher Ni content (0.1 wt.%) indicating interaction with the sulfide melt. Thus, interestingly, it is the metamorphic host rock which is the source of the silicate melt portion in the emulsion, and not the magmatic silicate melt. Demonstrating that a closer examination of these textures provides further insight in the processes of their creation.